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### DIOPHANTINE ANALYSIS.

134. Proposed by O. E. GLENN, Ph. D., Springfield, Mo.

How many sets of solutions has the congruence  $\lambda + \mu + \nu + \xi \equiv 0 \pmod{p-1}$   $p$  being a prime number; the order of  $\lambda, \mu, \nu, \xi$  being disregarded.

### GEOMETRY.

284. Proposed by JOHN JAMES QUINN, Ph. D., Warren, Pa.

a) Suppose that two radii  $R$  and  $r$ , whose center is the origin, revolve with uniform angular velocities  $3\theta$  and  $\theta$ , respectively. What is the equation of the locus of  $P$ , the projection parallel to the  $X$  axis of the extremity of the radius  $r$  on the radius  $R$  produced if necessary.

b) Apply this curve to the trisection of an angle.

c) Suppose the ratio of their velocities is  $n\theta:\theta$ . Show how we can effect the multisection of an angle.

285. Proposed by G. E. BROCKWAY, Nashua, N. H.

Prove without the aid of the circle, that if the bisectors of the angles of a triangle be drawn, the greatest bisector falls on the least side.

286. Proposed by S. F. NORRIS, Baltimore City College, Baltimore, Md.

On the sides of a given triangle measure off equal distances from the extremities of the base, and at these points erect perpendiculars to the sides. Find the locus of the point of intersection of these perpendiculars. Solve by methods of analytic geometry.

287. Proposed by G. W. GREENWOOD, M. A., McKendree College, Lebanon, Ill.

Show that the points whose abscissae are 0,  $a_1/\sqrt{3}$ , and  $-a_1/\sqrt{3}$  are points of inflexion on the locus  $x^2y - a^2x + a^2y = 0$ .

### MISCELLANEOUS.

157. Proposed by H. L. ORCHARD, M. A., B. Sc. (Unsolved problem in the Educational Times, London.)

An inelastic rod 9 feet long is placed with its upper end upon a rough vertical plane and its lower end on a smooth horizontal plane, and so that it makes an angle of  $45^\circ$  with each plane. It is now released, and strikes against a smooth sphere of 1 foot diameter placed in contact with the two planes. Determine the subsequent motion.

### UNSOLVED PROBLEMS.

NOTE. The following problems still remain unsolved (in our columns).

Group Theory, 8. Proposed by L. E. DICKSON, Ph. D., The University of Chicago.

In a chess tournament between eight players, there are seven rounds, the